VIKING PUMP

TECHNICAL SERVICE MANUAL

VIKING HYGIENIC SERIES
HYGIENIC INTERNAL GEAR PUMPS
SERIES 157B, 4157B, 257B & 4257B
STAINLESS STEEL
SIZES H, HL, KS, K, KK, LQ, LL, LS

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UNMOUNTED PUMP				UNITS
NON-JACKETED		JACKETED		
ORING SEAL	MECH SEAL	ORING SEAL	MECH SEAL	Units are designated by the un-mounted pump model numbers followed by a letter indicating drive style. V = V-Belt D = Direct Connected R = Viking Speed Reducer P = Commercial Speed Reducer or Gearmotor
H157B	H4157B	H257B	H4257B	
HL157B	HL4157B	HL257B	HL4257B	
KS157B	KS4157B	KS257B	KS4257B	
K157B	K4157B	K257B	K4257B	
KK157B	KK4157B	KK257B	KK4257B	
LQ157B	LQ4157B	LQ257B	LQ4257B	
LL157B	LL4157B	LL257B	LL4257B	
LS157B	LS4157B	LS257B	LS4257B	

INTRODUCTION

The illustrations used in this manual are for identification purposes only and cannot be used for ordering parts. Obtain a parts list from the factory or a Viking distributor. Always give the complete name of part, part number and material with the model number and serial number of pump when ordering repair parts. The unmounted pump or pump unit model number and serial number are on the nameplate.

In the Viking model number system, basic size letters are combined with series number (157B, 4157B, 257B, 4257B) indicating basic pump construction material.

This manual deals only with Series 157B, 4157B, 257B and 4257B hygienic pumps. **Refer to Figures 1 through 22** for general configuration and nomenclature used in this manual. Pump specifications and recommendations are listed in Catalog Section 230, Viking Hygienic Series: Hygienic Internal Gear Pumps.

FIGURE 1
NON-JACKETED HYGIENIC SERIES

FIGURE 2
JACKETED HYGIENIC SERIES

SAFETY INFORMATION AND INSTRUCTIONS

IMPROPER INSTALLATION, OPERATION OR MAINTENANCE OF PUMP MAY CAUSE SERIOUS INJURY OR DEATH AND/OR RESULT IN DAMAGE TO PUMP AND/OR OTHER EQUIPMENT. VIKING'S WARRANTY DOES NOT COVER FAILURE DUE TO IMPROPER INSTALLATION, OPERATION OR MAINTENANCE.

THIS INFORMATION MUST BE FULLY READ BEFORE BEGINNING INSTALLATION, OPERATION OR MAINTENANCE OF PUMP AND MUST BE KEPT WITH PUMP. PUMP MUST BE INSTALLED, OPERATED AND MAINTAINED ONLY BY SUITABLY TRAINED AND QUALIFIED PERSONS.

THE FOLLOWING SAFETY INSTRUCTIONS MUST BE FOLLOWED AND ADHERED TO AT ALL TIMES.

Symbol Legend :

Danger - Failure to follow the indicated instruction may result in serious injury or death.

WARNING

Warning - In addition to possible serious injury or death, failure to follow the indicated instruction may cause damage to pump and/or other equipment.

BEFORE opening any liquid chamber (pumping chamber, reservoir, etc.) be sure that :

- Any pressure in the chamber has been completely vented through the suction or discharge lines or other appropriate openings or connections.
- The pump drive system means (motor, turbine, engine, etc.) has been "locked out" or otherwise been made non-operational so that it cannot be started while work is being done on the pump.
- You know what material the pump has been handling, have obtained a material safety data sheet (MSDS) for the material, and understand and follow all precautions appropriate for the safe handling of the material.

BEFORE operating the pump, be sure all drive guards are in place.

DO NOT operate pump if the suction or discharge piping is not connected.

DO NOT place fingers into the pumping chamber or its connection ports or into any part of the drive train if there is **any possibility** of the pump shaft being rotated.

WARNING

DO NOT exceed the pump's rated pressure, speed, and temperature, or change the system/duty parameters from those the pump was originally supplied, without confirming its suitability for the new service.

WARNING

BEFORE operating the pump, be sure that:

- It is clean and free from debris
- All valves in the suction and discharge pipelines are fully opened.
- All piping connected to the pump is fully supported and correctly aligned with the pump.
- Pump rotation is correct for the desired direction of flow.

WARNING

INSTALL pressure gauges/sensors next to the pump suction and discharge connections to monitor pressures.

WARNING

USE extreme caution when lifting the pump. Suitable lifting devices should be used when appropriate. Lifting eyes installed on the pump must be used **only** to lift the pump, **not** the pump with drive and/or base plate. If the pump is mounted on a base plate, the base plate must be used for all lifting purposes. If slings are used for lifting, they must be safely and securely attached. For weight of the pump alone (which does not include the drive and/or base plate) refer to the Viking Pump product catalog.

AVOID contact with hot areas of the pump and/or drive. Certain operating conditions, temperature control devices (jackets, heat-tracing, etc.), improper installation, improper operation, and improper maintenance can all cause high temperatures on the pump and/or drive.

WARNING

THE PUMP must be provided with pressure protection. This may be provided through an in-line pressure relief valve, a torque limiting device, or a rupture disk. If pump rotation may be reversed during operation, pressure protection must be provided on both sides of pump. For additional information, refer to Viking Pump's Technical Service Manual TSM 000.

WARNING

THE PUMP must be installed in a matter that allows safe access for routine maintenance and for inspection during operation to check for leakage and monitor pump operation.

SPECIAL INFORMATION

DANGER !

Before opening any Viking pump liquid chamber (pumping chamber, reservoir, etc.) Be sure:

1. **That any pressure in the chamber has been completely vented through the suction or discharge lines or other appropriate openings or connections.**
2. **That the driving means (motor, turbine, engine, etc.) has been "locked out" or made non-operational so that it cannot be started while work is being done on pump.**
3. **That you know what liquid the pump has been handling and the precautions necessary to safely handle the liquid. Obtain a material safety data sheet (MSDS) for the liquid to be sure these precautions are understood.**

Failure to follow above listed precautionary measures may result in serious injury or death.

PRESSURE RELIEF:

1. Hygienic Series pumps are not available with an integral pressure relief valve.
2. Viking pumps are positive displacement pumps and must be provided with some sort of pressure protection. This may be an inline pressure relief valve, a torque limiting device, or a rupture disk.
3. If pump rotation is to be reversed during operation, pressure protection must be provided on ***both*** sides of pump.

For additional information on pressure relief valves, **refer to Technical Service Manual TSM000 and Engineering Service Bulletin ESB-31.**

METAL DETECTABLE COMPOSITE IDLERS:

1. Minimum detection limits will vary depending on individual customers' equipment and operating conditions.
2. Viking is not responsible for failure to detect components due to detector limitations and/or detector malfunctions. Refer to the metal detector manufacturer's design limitations, instructions, and warnings regarding the use, limitations, and proper maintenance of the equipment.

TEMPERATURE LIMITATIONS:

The standard Hygienic Series pumps have a maximum temperature limit of 225°F (107°C). Pumps with optional PEEK and Acetal idlers are limited to 200°F (93°C) and 125°F (52°C), respectively. Ensure that the temperature of the process liquid, cleaning fluid, and jacketing media does not exceed these temperature limits.

JACKETING:

On pumps with jacketed features, the maximum pressure limit for the jacketing is 225 psi. The maximum allowable temperature for the jacketing follows the guidelines of the temperature limitations section.

MAINTENANCE

Hygienic Series pumps are designed for long, trouble-free service life under a wide variety of application conditions with a minimum of maintenance. The points listed below will help provide long service life.

LUBRICATION:

No external lubrication is required. The H-LS Hygienic Series uses "Sealed for Life" bearings that use food grade grease with seals on both sides.

CLEANING PUMP:

Keep the pump as clean as possible. This will facilitate inspection, adjustment and repair work. Avoid spraying water or cleaning fluid directly at bearing housing.

STORAGE:

If the pump is not required for immediate installation, it should be stored in a clean, dry environment. It is recommended that storage temperature should be between 14°F and 105°F (–10° and 40°C).

SUGGESTED REPAIR TOOLS:

The following tools must be available to properly repair Hygienic Series pumps. These tools are in addition to standard mechanics' tools such as pliers, screwdrivers, etc. Most of the items can be obtained from an industrial supply house.

1. Soft headed hammer
2. Retainer socket tool (supplied with pump); Viking part number D14-8428-01
3. Rotor puller tool; Viking part number 3-464-TOOL-KIT
4. Bearing locknut socket (Source: Whittet-Higgins BAS Series or equal)
5. Torque wrench
6. Spanner wrench, adjustable pin type for use on bearing housing.

   (Source: # 482 J.H. Williams & Co. or equal)
7. Plastic bar
8. Impact wrench; calibrated or with torque stick
9. Arbor press
10. Allen Wrenches

Part Description	Pump Size			
	H-HL	KS-KK	LQ-LL	LS
End Cap Capscrews	1/8"	1/8"	1/8"	5/32"
Anti-Rotation Washer Capscrew	4 mm	5 mm	7/32"	7/32"
Idler Pin Capscrew	5/32"	5/32"	7/32"	7/32"
Bearing Housing Set Screws	3/32"	1/8"	1/8"	1/8"

11. Socket or Open-End Wrenches

Part Description	Pump Size		
	H-HL	KS-KK	LQ-LS
Head Nuts	7/16"	1/2"	9/16"

DRILLED IDLERS:

Some Hygienic Series pumps use a drilled idler and bushing. For replacement parts, Viking recommends purchasing the complete drilled idler and bushing subassembly from your local Authorized Viking Pump Distributor.

PREVENTIVE MAINTENANCE:

Every 6 months or every 2,000 hours of operation, whichever occurs first:

Re-torque rotor retainer to recommended torque value in **Table 1.**

Every 12 months:

1. Replace outer ball bearing.
2. Replace all O-rings including the idler pin O-ring.
3. Inspect and measure pump internals including the idler pin, idler, idler bushing, rotor, shaft, inner ball bearing, casing, and seal. Replace as necessary. Pump Inspection Reports can be obtained from your local Authorized Viking Pump Distributor.

INSPECTION OF SHAFT AND ROTOR SPLINE:

Each time the pump is disassembled the spline area of the shaft and rotor should be visually inspected. If the spline of the rotor or shaft is damaged or worn, replace the damaged or worn part. If the shaft shoulder next to the spline area has a sharp edge, use a fine emery cloth to remove the sharp edge to avoid damaging the seal. Wear to the shaft shoulder and the back of the rotor is caused by operating the pump with a loose rotor retainer. **It is critical that the rotor retainer be torqued properly to the value shown in Table 1.** Best practice is to use a calibrated impact wrench or an impact wrench with a properly sized torque stick.

CLEANING

Determine the on-site pump cleaning schedule for the materials being processed and the plant maintenance schedule.

COP (CLEAN OUT OF PLACE) RECOMMENDATIONS:

Hygienic Series pumps are suitable for manual cleaning. Please consider the following when manually cleaning a pump.

1. Use steps 1-4, 6-10 and 12-13 from the disassembly procedures to remove the wet end components. The locknut does not need to be removed and the bearing housing does not need to be adjusted during the disassembly for cleaning. The idler pin does not need to be removed from the head and the seal housing does not need to be removed from the casing unless the O-ring material of the pump is not compatible with the cleaning solution. For mechanically sealed pumps where the seal housing is not removed from the casing, make sure the stationary face(s), stationary face O-ring(s), and wave spring(s) are removed from the seal housing to avoid damaging the face(s) during cleaning. The bracket and shaft may be left in place to eliminate shaft realignment after reassembly.
2. Submerge and soak wet end components in Clean Out of Place tank with suitable cleaning solution. Soak pump components only long enough to ensure adequate cleaning.

WARNING!

ENSURE THAT THE CLEANING SOLUTION IS COMPATIBLE WITH PUMP COMPONENTS. PUMP PARTS SHOULD REMAIN IN CLEANING SOLUTION NO LONGER THAN NECESSARY TO AVOID CORROSION TO PUMP COMPONENTS.

3. Use new O-rings when reassembling the pump. Follow steps 7-9, 13 and 24-31 from the assembly procedures to reassemble the pump. As long as the thrust bearing was not adjusted, the end clearance should still be set correctly. Verify the end clearance and adjust if necessary before putting pump back into service. If the locknut needs to be retightened or the end clearance needs to be significantly adjusted (> 0.005”), follow the complete assembly procedures. Do not tighten the locknut or make major (> 0.005”) adjustments to the end clearance while the seal is installed in order to avoid damaging the seal faces of mechanical seals or disengaging the rotary O-ring of O-ring seals.

CIP (CLEAN IN PLACE) RECOMMENDATIONS:

Hygienic Series pumps are designed for in place cleaning. A partial bypass loop around the pump is recommended to control the pressure and flow across the pump during the CIP process. Please consider the following recommendations when designing and installing a CIP system.

1. Casing must be installed with one port oriented downward to allow liquid to drain from the casing. The port with a casing groove needs to be used as the suction port for the pump’s primary rotation.
2. Differential pressure must be created across the pump during the cleaning process in order to force the cleaning solution through the clearances of the pump. A differential pressure of 15 to 30 psi (1 to 2 bar) across the pump during the cleaning process is adequate for most applications.
3. The velocity of the cleaning solution must be sufficient to clean the entire system. A velocity of 5 ft/sec (1.5 m/s) in a pipe of equal diameter to the pump port connections is adequate for most applications. For example in a pump with 2” ports, the flow rate needs to be 49 gpm (185 lpm). An additional CIP supply pump may be used if the pump cannot meet the CIP velocity requirements.
4. It is recommended that the pump rotates during the CIP process to increase turbulence, which will assist with the cleaning process.
5. Ensure that the cleaning solution is compatible with all of

WARNING!

IF STEAM IS USED DURING THE CIP CYCLE, THE PUMP SHOULD NOT BE ALLOWED TO ROTATE DURING THE STEAMING PROCESS.

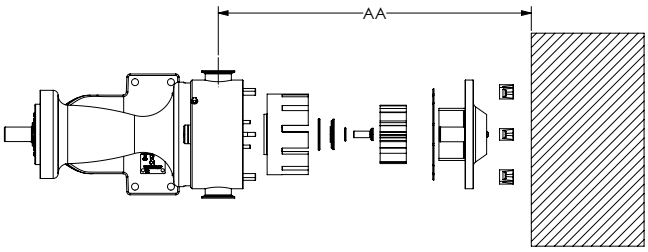
the pump materials.

SOILED ROTOR RETAINER CLEANING PROCEDURES:

1. Use steps 1, 4 and 6-8 from the disassembly procedures to remove the rotor retainer components.
2. If rotor retainer blind tapped hole is soiled, submerge and soak rotor retainer for 5 minutes in Clean Out of Place tank with suitable cleaning solution.
3. Scrub both external and internal threads with appropriate bristle brush and suitable cleaning solution.
4. Rinse with clean water and dry blind tapped hole with clean air.
5. Use new O-rings when reassembling the pump. Follow steps 27 and 29-31 from the assembly procedures to reassemble the pump. As long as the thrust bearing was not adjusted, the end clearance should still be set correctly. Verify the end clearance and adjust if necessary before putting pump back into service. If the locknut needs to be retightened or the end clearance needs to be significantly adjusted (> 0.005”), follow the complete assembly procedures. Do not tighten the locknut or make major (> 0.005”) adjustments to the end clearance while the seal is installed in order to avoid damaging the seal faces of mechanical seals or disengaging the rotary O-ring of O-ring seals.

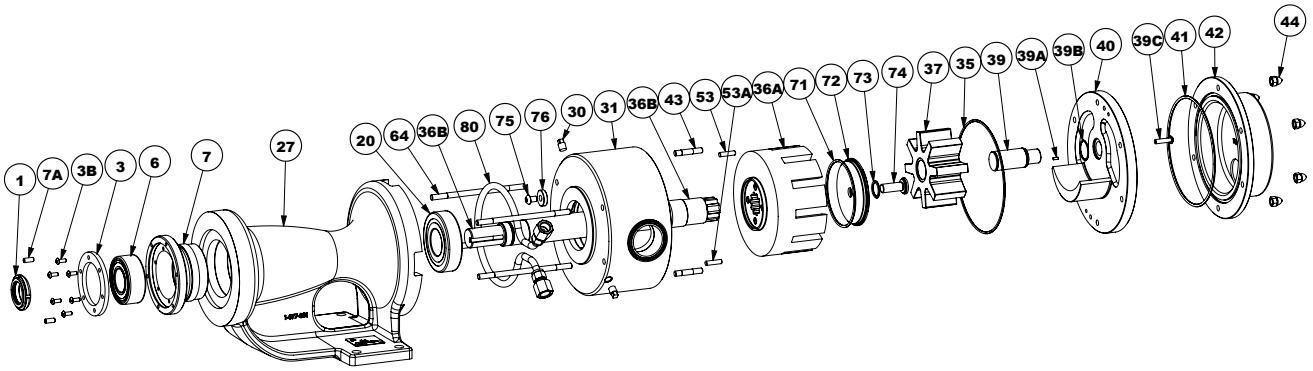
Note: Install new rotor retainer if debris remains after cleaning. It is recommended that the rotor retainer O-rings be replaced every 12 months to maintain a tight seal.

REQUIRED CLEARANCE FOR DISASSEMBLY



Pump Size	Required to Remove Pump Internals (AA)	
	Inch	mm
H	14-1/4	362
HL	15-1/2	394
KS	19-1/4	489
K	19-3/4	502
KK	20-3/4	527
LQ	23	584
LL	24	610
LS	24-3/4	629

FIGURE 3
CLEARANCE FOR DISASSEMBLY



ITEM	NAME OF PART	ITEM	NAME OF PART	ITEM	NAME OF PART
1	Locknut	**36A**	Rotor	**53**	Head Alignment Dowel Pin
3	End Cap	**36B**	Shaft	**53A**	Large Head Alignment Dowel Pin
3B	Capscrew for End Cap	**37**	Idler and Bushing Assembly	**64**	Stud for Casing
6	Ball Bearing (Outer)	**39**	Idler Pin	**71**	Rotor Retainer Cap O-ring
7	Bearing Housing	**39A**	Idler Pin Dowel Pin	**72**	Rotor Retainer Cap
7A	Set Screw	**39B**	Idler Pin O-ring	**73**	Rotor Retainer O-ring
19	Seal (Not Shown)	**39C**	Capscrew for Idler Pin	**74**	Rotor Retainer
20	Ball Bearing (Inner)	**40**	Head	**75**	Capscrew for Anti-Rotation Washer
27	Bracket	**41**	O-ring for Jacket Head Plate	**76**	Anti-Rotation Washer
30	Pipe Plug	**42**	Jacket Head Plate	**80**	Jacket Tubing for Bracket
31	Casing	**43**	Stud for Head		
35	Head O-ring	**44**	Nut for Head		

FIGURE 4
EXPLODED VIEW FOR HYGIENIC SERIES MODELS

DISASSEMBLY

DANGER !

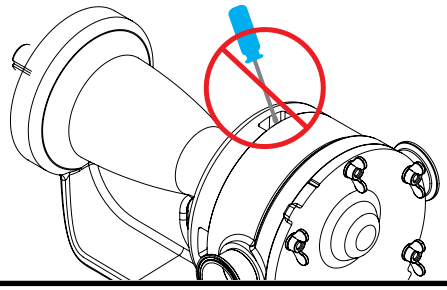
Before opening any Viking pump liquid chamber (pumping chamber, reservoir, etc.) Be sure:

1. **That any pressure in the chamber has been completely vented through the suction or discharge lines or other appropriate openings or connections.**
2. **That the driving means (motor, turbine, engine, etc.) has been "locked out" or made non-operational so that it cannot be started while work is being done on pump.**
3. **That you know what liquid the pump has been handling and the precautions necessary to safely handle the liquid. Obtain a material safety data sheet (MSDS) for the liquid to be sure these precautions are understood.**

Failure to follow above listed precautionary measures may result in serious injury or death.

WARNING !

DO NOT INSERT TOOLS IN THE VIEWING GAPS BETWEEN THE CASING AND BRACKET OR DAMAGE TO THE SHAFT, SEAL, AND BEARING WILL RESULT.



1. Remove the head nuts. If pump has a jacketed head plate, remove the jacketed head plate and O-ring. Remove head from pump. Jack screw holes (1/4"-20 for H-KK; 3/8"-16 for LQ-LS) are included to assist with head removal. Do not allow idler to fall from idler pin. Tilt top of head back when removing to prevent this. Remove the head O-ring.
2. After removing the head, use two nuts to hold the casing in place during disassembly. These nuts should be located on opposite sides of the casing. A spacer or a couple of larger nuts will need to be used to compensate for the unthreaded section of the casing studs. It is important the casing is secured during disassembly to avoid damage to the pump internals.
3. Remove the idler pin capscrew. Remove the idler pin, idler pin dowel pin, and idler pin O-ring. If the idler pin is difficult to remove from the head, partially thread the idler pin capscrew back into the idler and use it to dislodge the idler pin from the head.
4. Insert plastic bar through port opening between rotor teeth to keep shaft from turning.
5. For O-ring sealed pumps, remove the end cap of the bearing housing by removing the end cap capscrews, and use a bearing locknut socket to turn the locknut counterclockwise and remove locknut. **See Figure 7.** Do not loosen or remove locknut of mechanically sealed pumps while the seal is installed in order to avoid damaging the seal faces. The locknut for mechanically sealed pumps will be removed in step 11.
6. Use the retainer socket tool to unscrew the rotor retainer. Turn counter-clockwise to loosen, clockwise to tighten.
7. Remove the rotor retainer O-ring, rotor retainer cap, and rotor retainer cap O-ring. **See Figure 5.** Inspect the rotor retainer blind tapped hole for contamination. If soiled, **refer to the soiled rotor retainer cleaning procedures.**

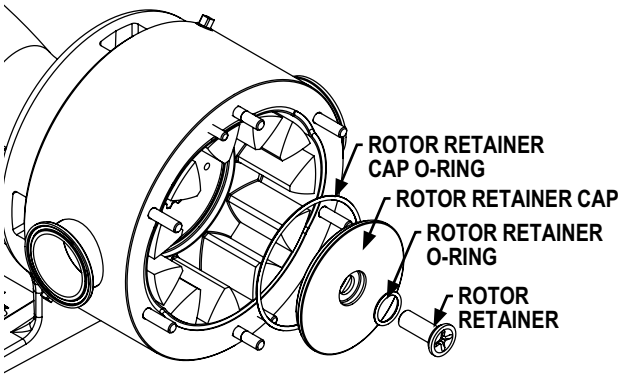
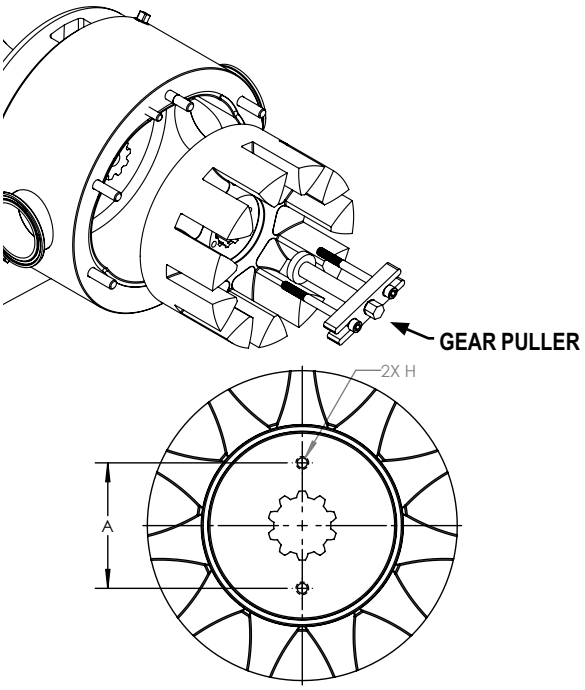


FIGURE 5
ROTOR RETAINER ASSEMBLY

8. Remove plastic bar from port opening.
9. Under the rotor retainer cap are two drilled and tapped holes to assist in the removal of the rotor. These holes do not extend through the rotor and are not designed for jackscrews. If the rotor is not removable by hand, use the gear puller tool in these holes to remove the rotor. Before using the gear puller tool, reinstall the rotor retainer to give the gear puller something to push against in order to avoid damaging the threads for the rotor retainer. **See Figure 6.** The rotary member of the seal will be removed with the rotor. Take care not to damage the seal components when removing the rotor. Remove the seal rotary member after the rotor has been removed from the casing.
10. For mechanically sealed pumps, remove the stationary face(s) and wave spring(s) from the seal housing. Take care not to damage the stationary face(s).
11. For mechanically sealed pumps, reinstall the rotor onto the shaft by lining up the splines on both components. Insert plastic bar through port opening between rotor teeth to keep shaft from turning. Remove the end cap of the bearing housing by removing the end cap capscrews. Use a bearing locknut socket to turn the locknut counterclockwise and remove locknut. Remove the plastic bar from port opening. Remove the rotor from the casing as described in step 9.
12. Remove the two nuts added in step 2. Remove the casing.
13. Remove the seal housing from the casing.
14. Remove the anti-rotation washer from the casing.
15. Remove the shaft from the pump.
16. Remove the inner single row ball bearing from the shaft if the bearing needs to be replaced. **Refer to Disassembly and Installation of Inner Ball Bearing, page 13.**



Pump Size	Hole Spacing 'A' (inch)	Thread Size 'H' (inch)
H, HL	1 - 3/4	1/4 - 20
KS-LS	2 - 1/2	1/4 - 20

FIGURE 6
ROTOR REMOVAL

17. Loosen the two setscrews in the face of the bearing housing and turn the thrust bearing assembly counter-clockwise with a pin type spanner wrench and remove from bracket. **See Figure 7.**

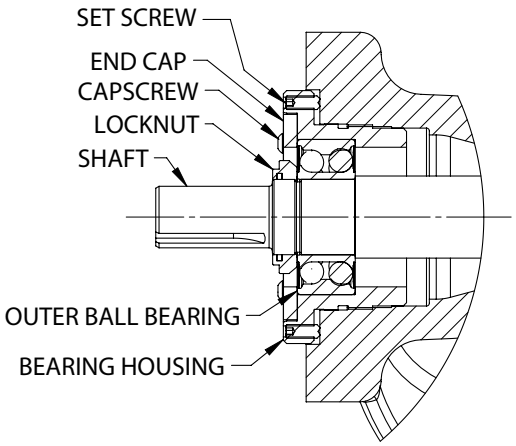


FIGURE 7
THRUST BEARING ASSEMBLY

18. Disassemble the thrust bearing assembly by removing the outer ball bearing. **See Figure 7.**

19. Clean all parts thoroughly and examine for wear and damage. Check ball bearings, idler bushing, and idler pin and replace if necessary. The casing should be examined for wear, particularly in the area between the ports. Check all other parts for nicks, burrs, excessive wear and replace if necessary. All O-rings should be replaced.

Make sure bearings are clean, and then check for roughness. Roughness can be determined by turning outer race by hand. Replace bearings if necessary.

Be sure the shaft is free from nicks, burrs and foreign particles that might damage the mechanical seal. Scratches on the shaft in the seal area will provide leakage paths under the mechanical seal. Use a fine emery cloth to remove scratches or sharp edges.

ASSEMBLY

DANGER !

BEFORE STARTING PUMP, BE SURE ALL DRIVE EQUIPMENT GUARDS ARE IN PLACE.

FAILURE TO PROPERLY MOUNT GUARDS MAY RESULT IN SERIOUS INJURY OR DEATH.

It is recommended that new O-rings be used for reassembly of the pump.

All O-rings should be lightly lubricated with an appropriate lubricant that is suitable for the application before installing.

The fastener torque values are listed in **Table 1.** Use food grade anti-seize when installing all fasteners except for the locknut.

Description		H-HL	KS-KK	LQ-LL	LS
End Cap Capscrews (Button Head)	Thread Size	#10-24	#10-24	#10-24	1/4"
	Anti-Seize Torque (ft-lbs)	1-2	1-2	1-2	4-5
Anti-Rotation Washer Capscrew (Button Head)	Thread Size	M6	M8	3/8"	3/8"
	Anti-Seize Torque (ft-lbs)	2-3	5-6	13-14	13-14
Rotor Retainer	Thread Size	3/8"	1/2"	1/2"	1/2"
	Anti-Seize Torque (ft-lbs)	30-35	30-35	30-35	30-35
Idler Pin Capscrew (Button Head)	Thread Size	1/4"	1/4"	3/8"	3/8"
	Anti-Seize Torque (ft-lbs)	4-5	4-5	13-14	13-14
Head Nuts	Thread Size	1/4"	5/16"	3/8"	3/8"
	Anti-Seize Torque (ft-lbs)	4-5	7-8	13-14	13-14
Locknut	Size	N-05	N-07	N-07	N-08
	Dry Torque (ft-lbs)	50-70	100-130	100-130	120-150

TABLE 1
FASTENER TORQUE VALUES

1. On jacketed pumps, install jacket tubing onto the bracket by squeezing the tubing between the slots of the bracket flange. Make sure that the tubing does not extend past the flange surface and interfere with installation of the casing.

2. Use an arbor press to install the inner single row ball bearing onto the shaft. **Refer to Disassembly and Installation of Inner Ball Bearing, page 13.** The inner bearing in this pump is a "Sealed for Life" bearing that has seals on both sides. This bearing can be installed either side first and does not need to be packed with grease.

3. Coat the shaft with light food grade oil. Install the shaft and bearing into the bracket from the pump end.

4. Install the outer ball bearing into the bearing housing. The outer ball bearing is a “Sealed for Life” bearing that has seals on both sides. This bearing can be installed either side first and does not need to be packed with grease. Do not install the end cap. **See Figure 7.**

5. Start the thrust bearing assembly into the bracket. Use a pin type spanner wrench to install the thrust bearing assembly but do not over-tighten. The thrust bearing assembly will be used later to set the end clearance of the pump after the head of the pump has been installed.

6. Install the locknut on the shaft and hand tighten to keep the shaft in place while the rotor is installed.

7. Install the anti-rotation washer in the bracket side of the casing with the anti-rotation washer capscrew. The chamfer side of the washer needs to be facing the casing. For single seals, install pipe plugs in the seal barrier/buffer fluid holes. These holes are only used for double seals. Press the head alignment dowel pins into the casing if they are not already installed.

8. Install the casing studs in the bracket if they are not already installed. Use a suitable food grade threadlocker when installing the casing studs in the bracket. **Refer to casing stud locations shown in Installation of Casing Studs, page 13.** Use the casing studs to install the casing on the bracket. The port with a casing groove needs to be used as the suction port for the pump’s primary rotation. For clean in place pumps, one port must be oriented downward to allow the pump to be self-draining.

9. Use two nuts to hold the casing in place during assembly. These nuts should be located on opposite sides of the casing. A spacer or a couple of larger nuts will need to be used to compensate for the unthreaded section of the casing studs. It is important the casing is secured during assembly to avoid damage to the pump internals.

10. Install the rotor onto the shaft by lining up the splines on both components.

11. Install the rotor retainer cap onto the rotor. Coat threads of rotor retainer with food grade anti-seize. Secure in place using the rotor retainer. Insert length of plastic bar through port opening between rotor teeth to keep shaft from turning. Torque the rotor retainer to value shown in **Table 1** using the retainer socket tool. **It is critical that the rotor retainer be torqued properly.** Best practice is to use a calibrated impact wrench or an impact wrench with a properly sized torque stick. Remove plastic bar from port opening. **See Figure 5.**

12. Remove the two nuts added in step 9.

13. Place the idler pin O-ring into the counterbore on the head. Install the idler pin dowel pin into the idler pin. Align the dowel pin with the hole or groove in the bore for the idler pin, and install the idler pin into the head. Secure the idler pin to the head using the idler pin capscrew.

14. Coat idler pin with light food grade oil and place idler and bushing on idler pin in head. If replacing the idler bushing, **refer to Installation of Bushings, page 14.**

15. Install the head studs in the casing. Use a suitable food grade threadlocker when installing the head studs in the casing. Install the head and idler assembly on pump. If pump is equipped with a jacketed head plate, install the jacketed head plate at this time.

16. Install the head nuts to secure the head to the casing. Make sure the nuts are tightened so the end clearance can be set accurately.

17. Insert length of plastic through port opening between rotor teeth to keep shaft from turning. Torque locknut to value shown in **Table 1** using a bearing locknut socket and a torque wrench. Failure to tighten locknut could result in premature bearing failure and cause damage to pump. Remove length of plastic from port opening. The locknut needs to be tightened before the seal is installed to prevent damaging the seal faces of mechanical seals or disengaging the rotary O-ring of O-ring seals.

18. Install the end cap into the bearing housing and secure with the end cap capscrews. Adjust pump end clearance. **Refer to Thrust Bearing Adjustment, page 14.** The end clearance needs to be set before the seal is installed to prevent damaging the seal faces of mechanical seals or disengaging the rotary O-ring of O-ring seals.

19. Remove the head nuts. If pump has a jacketed head plate, remove the jacketed head plate. Remove head from pump. Jack screw holes (1/4”-20 for H-KK; 3/8”-16 for LQ-LS) are included to assist with head removal. Do not allow idler to fall from idler pin. Tilt top of head back when removing to prevent this.

20. Secure casing during assembly by repeating step 9.

21. Insert plastic bar through port opening between rotor teeth to keep shaft from turning. Use the retainer socket tool to unscrew the rotor retainer.

22. Remove the rotor retainer cap. **See Figure 5.**

23. Under the rotor retainer cap are two drilled and tapped holes to assist in the removal of the rotor. These holes do not extend through the rotor and are not designed for jackscrews. If the rotor is not removable by hand, use the gear puller tool in these holes to remove the rotor. Before using the gear puller tool, reinstall the rotor retainer to give the gear puller something to push against in order to avoid damaging the threads for the rotor retainer. **See Figure 6.**

24. Install the stationary member of the seal in the casing. **Refer to the additional seal installation instructions in the Seal Installation section, page 9.** The casing may need to be backed away or removed from the bracket to assist with installation of the seal.

25. Install the rotary member of the seal on the back of the rotor. **Refer to the additional seal installation instructions in the Seal Installation section, page 9.**

26. Make sure casing is secure as described in step 9. Install the rotor onto the shaft by lining up the splines on both components. Take care not to damage the seal and ensure that the rotary member of the seal does not slip out of position.

27. Coat threads of rotor retainer with food grade anti-seize. Install the rotor retainer cap O-ring onto the rotor retainer cap. Install the rotor retainer O-ring onto the rotor retainer. Install rotor retainer through the rotor retainer cap onto the rotor and shaft. Insert length of plastic bar through port opening between rotor teeth to keep shaft from turning. Torque the rotor retainer to value shown in **Table 1** using the retainer socket tool. **It is critical that the rotor retainer be torqued properly.** Best practice is to use

a calibrated impact wrench or an impact wrench with a properly sized torque stick. Remove plastic bar from port opening. **See Figure 5.**

28. Remove the two nuts securing the casing.
29. Coat idler pin with light food grade oil and place idler and bushing on idler pin in head. If replacing the idler bushing, **refer to Installation of Bushings, page 14.**
30. Install the head studs in the casing if they are not already installed. Use a suitable food grade threadlocker when installing the head studs in the casing. Place the head O-ring on the casing. The head O-ring may need to be stretched to fit onto the casing. Install the head and idler assembly on pump. Use the head alignment dowel pins to ensure proper reassembly. Make sure the idler pin, which is offset in the pump head, is positioned equal distance between port connections to allow for proper flow of liquid through the pump. **Refer to idler pin placement shown in Pump Rotation, page 13.** If pump is equipped with a jacketed head plate, install the jacketed head plate and a new jacketed head plate O-ring.
31. Install the head nuts to secure the head to the casing.
32. After the pump is fully assembled with the seal installed, verify the end clearance with a feeler gauge and adjust if necessary before putting pump into service. Only minor adjustments to the end clearance of less than 0.005" can be made while the seal is installed. **Refer to Thrust Bearing Adjustment, page 14.** If major (> 0.005") adjustments to the end clearance are necessary, remove the seal before adjusting the end clearance. Seal removal instructions are listed in the **Seal Installation section, page 9.** Once the seal is removed repeat the assembly procedures starting at step 8 to adjust the end clearance and reassemble the pump.

SEAL INSTALLATION

DANGER !

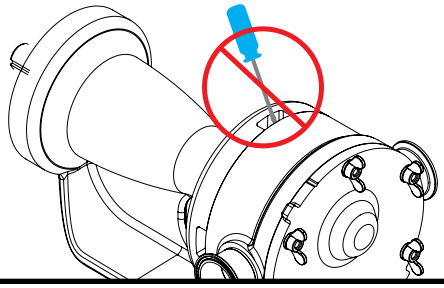
Before opening any Viking pump liquid chamber (pumping chamber, reservoir, etc.) Be sure:

1. **That any pressure in the chamber has been completely vented through the suction or discharge lines or other appropriate openings or connections.**
2. **That the driving means (motor, turbine, engine, etc.) has been "locked out" or made non-operational so that it cannot be started while work is being done on pump.**
3. **That you know what liquid the pump has been handling and the precautions necessary to safely handle the liquid. Obtain a material safety data sheet (MSDS) for the liquid to be sure these precautions are understood.**

Failure to follow above listed precautionary measures may result in serious injury or death.

WARNING !

DO NOT INSERT TOOLS IN THE VIEWING GAPS BETWEEN THE CASING AND BRACKET OR DAMAGE TO THE SHAFT, SEAL, AND BEARING WILL RESULT.



The seal used in this pump is simple to install and good performance will result if care is taken during installation.

The primary sealing area of a mechanical seal is between the faces of the rotary and stationary members. These parts are lapped to a high finish and their sealing effectiveness depends on complete contact.

Never touch the sealing faces with anything except clean hands or clean cloth. Minute particles can scratch the seal faces and cause leakage.

Seal Removal:

Use steps 1-2, 4, 6-10, and 12-13 from the disassembly procedures to remove the seal components. The locknut does not need to be removed and the bearing housing does not need to be adjusted during seal removal. The bracket and shaft may be left in place to eliminate shaft realignment after reassembly.

Seal Installation:

Follow the rotary and stationary member installation instructions for the seal type used in the pump. Use steps 24-31 from the assembly procedures to reassemble the pump. As long as the thrust bearing was not adjusted, the end clearance should still be set correctly. Verify the end clearance and adjust if necessary before putting pump back into service. If the locknut needs to be retightened or the end clearance needs to be significantly adjusted (> 0.005"), follow the complete assembly procedures. Do not tighten the locknut or make major (> 0.005") adjustments to the end clearance while the seal is installed in order to avoid damaging the seal faces of mechanical seals or disengaging the rotary O-ring of O-ring seals.

SINGLE MECHANICAL SEAL

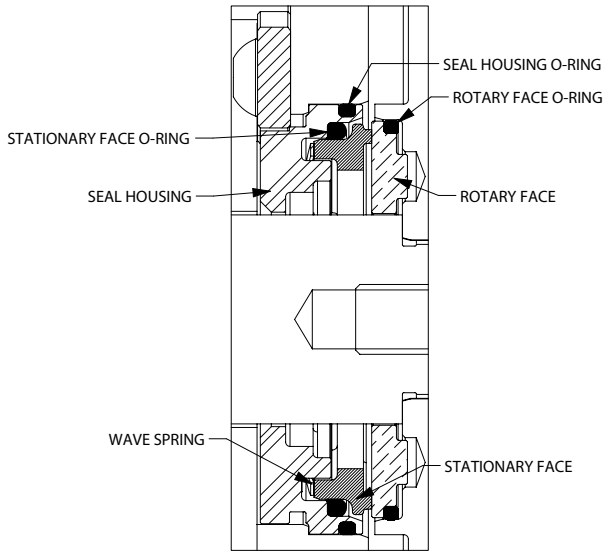


FIGURE 8
SINGLE SEAL CROSS SECTION

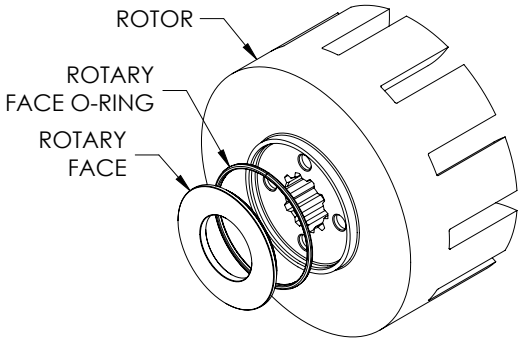


FIGURE 9
SINGLE SEAL ROTARY MEMBER

Rotary Member Installation (FIGURE 9):

1. Install the rotary face O-ring onto the back of the rotary face.
2. Install the rotary face onto the backside of the rotor. Make sure that the lugs on the backside of the rotary face line up with the anti-rotation holes in the rotor.

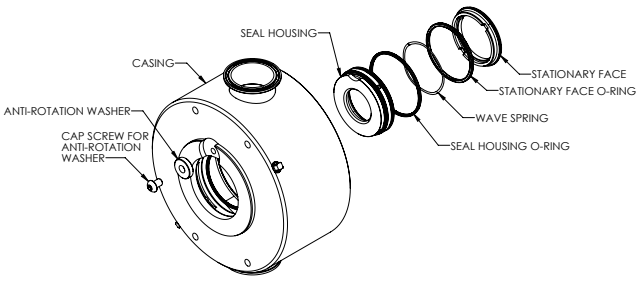


FIGURE 10
SINGLE SEAL STATIONARY MEMBER

Stationary Member Installation (FIGURE 10):

1. Install the seal housing O-ring into the seal housing.
2. Install the seal housing into the casing. When installing the seal housing into the casing, the anti-rotation cut out of the seal housing must line up with the anti-rotation washer on the backside of the casing.
3. Install the wave spring into the seal housing.
4. Install the stationary face O-ring onto the stationary face.
5. Install the stationary face into the seal housing. Line up the notches on the back of the stationary face with the tabs on the seal housing.

DOUBLE MECHANICAL SEAL

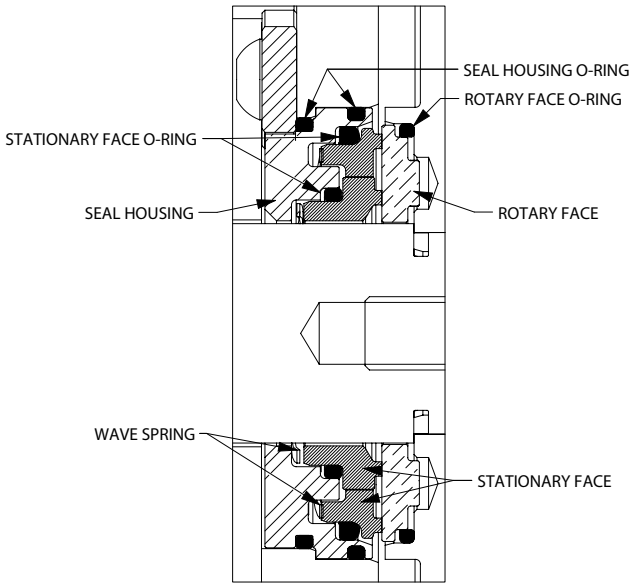


FIGURE 11
DOUBLE SEAL CROSS SECTION

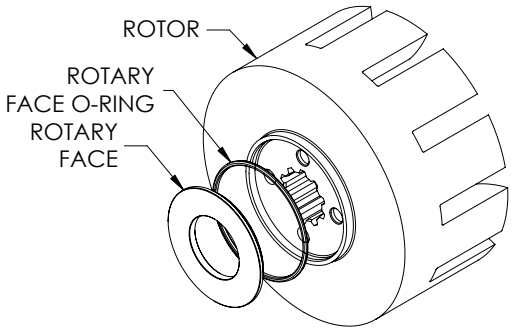


FIGURE 12
DOUBLE SEAL ROTARY MEMBER

Rotary Member Installation (FIGURE 12):

1. Install the rotary face O-ring onto the back of the rotary face.
2. Install the rotary face onto the backside of the rotor. Make sure that the lugs on the backside of the rotary face line up with the anti-rotation holes in the rotor.

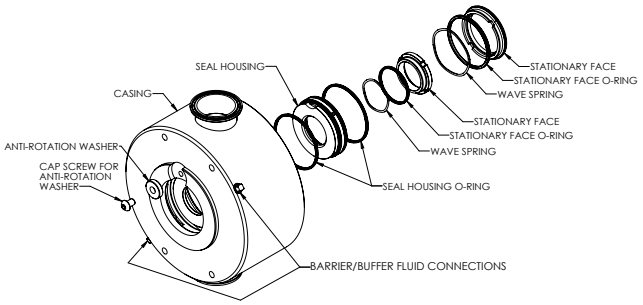


FIGURE 13
DOUBLE SEAL STATIONARY MEMBER

Stationary Member Installation (FIGURE 13):

1. Install the two seal housing O-rings into the seal housing.

2. Install the seal housing into the casing. When installing the seal housing into the casing, the anti-rotation cut out of the seal housing must line up with the anti-rotation washer on the backside of the casing.

3. Install the wave springs into the seal housing.

4. Install the stationary face O-rings onto the stationary faces.

5. Install the stationary faces into the seal housing. Line up the notches on the back of the stationary faces with the tabs on the seal housing.

SINGLE O-RING SEAL

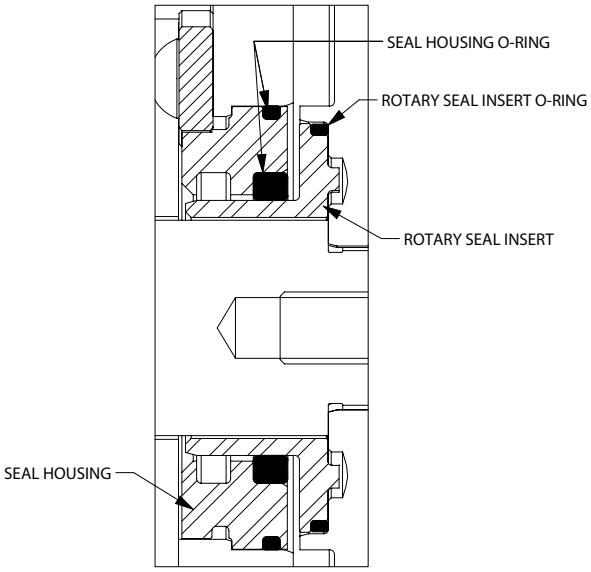


FIGURE 14
SINGLE O-RING SEAL CROSS SECTION

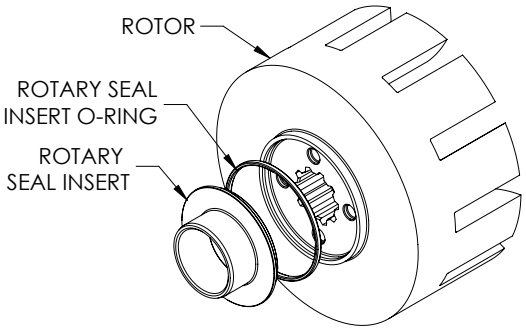


FIGURE 15
SINGLE O-RING SEAL ROTARY MEMBER

Rotary Member Installation (FIGURE 15):

1. Install the rotary seal insert O-ring onto the rotary seal insert.

2. Install the rotary seal insert onto the backside of the rotor. Make sure that the lugs on the backside of the rotary seal insert line up with the anti-rotation holes in the rotor.

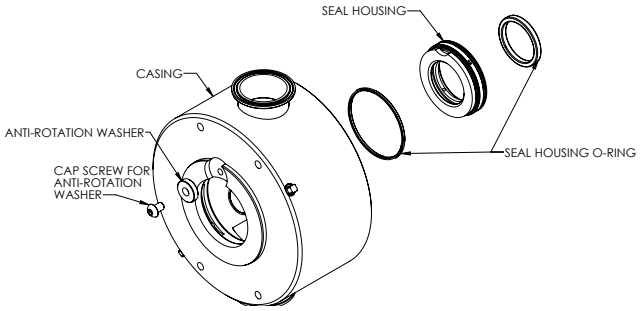


FIGURE 16
SINGLE O-RING SEAL STATIONARY MEMBER

Stationary Member Installation (FIGURE 16):

1. Install the two seal housing O-rings into the seal housing.

2. Install the seal housing into the casing. When installing the seal housing into the casing, the anti-rotation cut out of the seal housing must line up with the anti-rotation washer on the backside of the casing.

DOUBLE O-RING SEAL

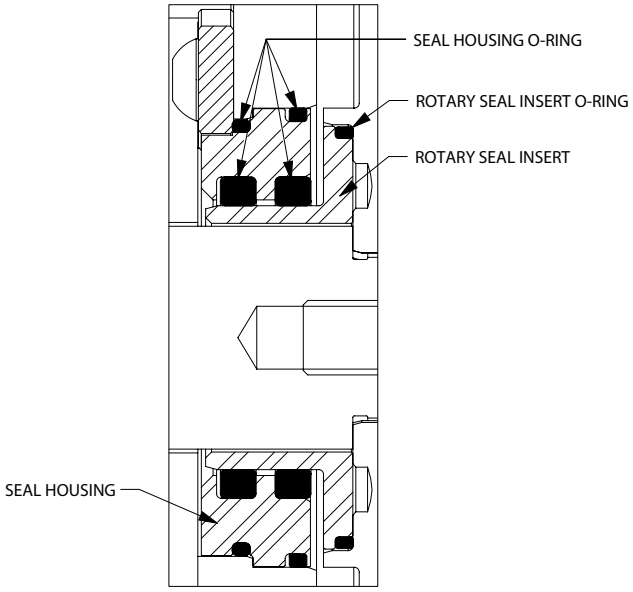


FIGURE 17
DOUBLE O-RING SEAL CROSS SECTION

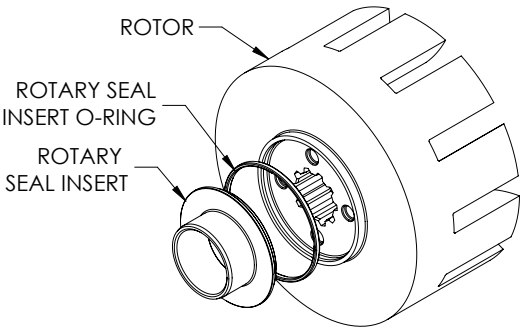


FIGURE 18
DOUBLE O-RING SEAL ROTARY MEMBER

Rotary Member Installation (FIGURE 18):

1. Install the rotary seal insert O-ring onto the rotary seal insert.
2. Install the rotary seal insert onto the backside of the rotor. Make sure that the lugs on the backside of the rotary seal insert line up with the anti-rotation holes in the rotor.

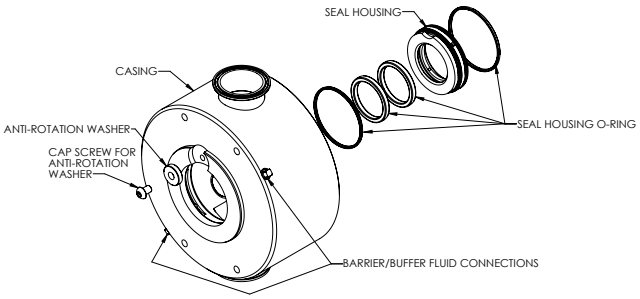


FIGURE 19
DOUBLE O-RING SEAL STATIONARY MEMBER

Stationary Member Installation (FIGURE 19):

1. Install the four seal housing O-rings into the seal housing.
2. Install the seal housing into the casing. When installing the seal housing into the casing, the anti-rotation cut out of the seal housing must line up with the anti-rotation washer on the backside of the casing.

BARRIER/BUFFER FLUID FOR DOUBLE SEAL & DOUBLE O-RING SEAL

WARNING !

PUMPS WITH DOUBLE SEALS AND DOUBLE O-RING SEALS REQUIRE A LIQUID BARRIER/ BUFFER FLUID. OPERATING A PUMP WITH A DOUBLE SEAL OR DOUBLE O-RING SEAL WITHOUT A BARRIER/BUFFER FLUID WILL DAMAGE THE SEAL AND PUMP PARTS DUE TO EXCESS HEAT CAUSED BY DRY RUNNING.

THE BARRIER/BUFFER FLUID FOR THE SEAL MUST BE COMPATIBLE WITH THE PRODUCT BEING PUMPED AND THE RELEVENT MATERIALS OF CONSTRUCTION OF THE PUMP.

SPECIAL CONSIDERATION MUST BE GIVEN TO THE TEMPERATURE LIMITATIONS OF THE BARRIER/BUFFER FLUID TO ENSURE NO FIRE OR EXPLOSION HAZARDS ARE CREATED.

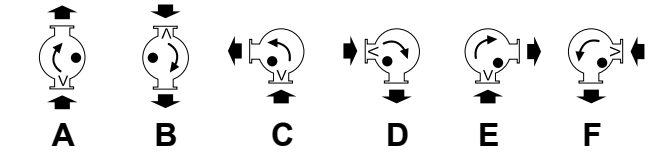
1. Pumps with double seals and double O-ring seals require a barrier/buffer fluid. The barrier/buffer fluid must be connected and flowing whenever the pump is operated.
2. The barrier/buffer fluid must be supplied at a minimum flow rate of 0.13 gpm (0.5 lpm).
3. For a buffer fluid, the fluid should be unpressurized
4. For a barrier fluid, the fluid pressure must be a minimum of 15 psi (1 bar) greater than the maximum pressure behind the rotor. Due to the casing groove, the pressure behind the rotor is equal to the suction pressure for the pump's primary rotation and the discharge pressure for the opposite rotation.
5. To obtain maximum seal life, use cool, clean barrier/ buffer fluid. Use warm or hot barrier/buffer fluid if the pumped product sets up at room temperature.
6. The barrier/buffer fluid connections are shown in **Figures 13 and 19.** The NPT connection sizes for the barrier/buffer fluid are 1/16" for H-HL and 1/8" for KS-LS. Use the lower connection as the inlet and the higher connection as the outlet for the barrier/buffer fluid.

PUMP ROTATION

Hygienic Series pumps have a primary direction of rotation with an integral suckback groove to cool and lubricate the seal. The port with the casing groove must be used as the suction port for the pump's primary rotation. Pumps may be operated in the opposite direction for short periods of time such as for stripping the line before cleaning. Running the pump in the opposite direction turns the casing groove into a flush groove, which causes the area behind the rotor and the seal to be subjected to the discharge pressure. Pressure protection must be provided downstream of the pump, regardless of rotation, or damage to the pump or drive may result.

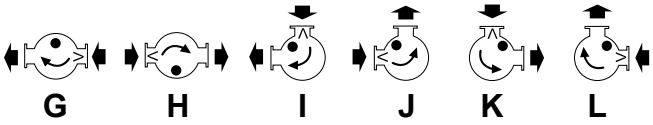
The port with a casing groove (shown as V) needs to be used as the suction port for the pump's primary rotation. Due to the casing groove location, orientations C, F, J and K will require a special casing.

Idler pin (shown as ●) and rotation shown is as viewed from shaft end of pump.



CIP-able Port Options

one port oriented downwards for drainability



Additional Options for COP

FIGURE 20
PUMP ROTATION

INSTALLATION OF CASING STUDS

Use **Figure 21 and Table 2** to determine casing stud location for your casing orientation. You can see the available casing orientations in **Figure 20. Note: Figure 21** is as viewed from the head end of the pump and **Figure 20** is as viewed from the shaft end of the pump.

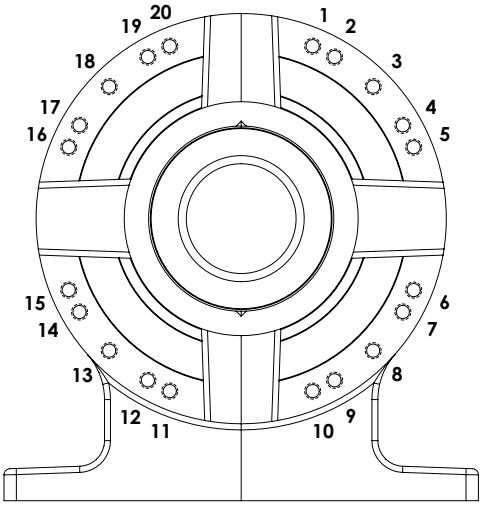


FIGURE 21
LOCATION OF CASING STUDS

Pump Size	Casing Orientation (See Figure 20)	Location of Casing Studs (See Figure 21)
H, HL, LQ, LL, LS	A & B	2, 9, 12, 19
H, HL, LQ, LL, LS	G & H	4, 7, 14, 17
KS, K, KK	A	1, 10, 12, 19
KS, K, KK	B	2, 9, 11, 20
KS, K, KK	G	4, 6, 15, 17
KS, K, KK	H	5, 7, 14, 16
All Sizes	C & D	1, 8, 15, 18
All Sizes	E & F	3, 6, 13, 20
All Sizes	I & J	3, 10, 13, 16
All sizes	K & L	5, 8, 11, 18

TABLE 2
LOCATION OF CASING STUDS

DISASSEMBLY & INSTALLATION OF INNER BALL BEARING

1. A press must be used for disassembly and installation of the inner ball bearing.
2. Take care not to damage the spline end of the shaft. If you must press on the spline end, use a spacer to protect the spline end.
3. Make sure the inner race of the bearing is properly supported.

4. Make sure the shaft is perpendicular to the face of the bearing.
5. Using a food grade lubricant on the inner race and shaft will help with the installation.
6. Press the bearing onto the shaft until the inner race contacts the shoulder in the shaft.

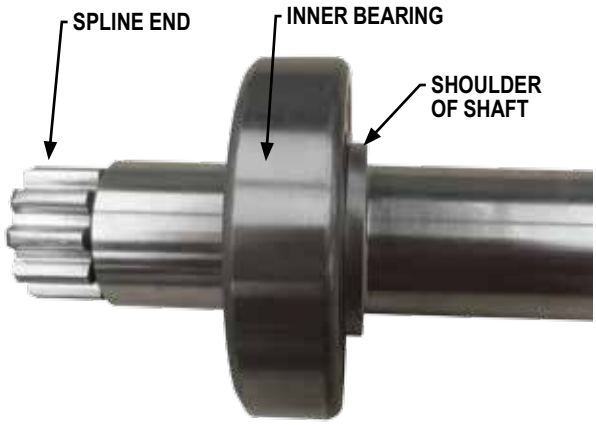


FIGURE 22
INNER SINGLE ROW BALL BEARING

THRUST BEARING ADJUSTMENT

DANGER !

MAKE SURE THAT THE DRIVING MEANS (MOTOR, TURBINE, ENGINE, ETC.) HAS BEEN "LOCKED OUT" OR MADE NON-OPERATIONAL SO THAT IT CANNOT BE STARTED WHILE WORK IS BEING DONE ON PUMP.

WARNING !

DO NOT TIGHTEN THE LOCKNUT OR MAKE MAJOR ADJUSTMENTS TO THE END CLEARANCE WHILE THE SEAL IS INSTALLED IN ORDER TO AVOID DAMAGING THE SEAL FACES OF MECHANICAL SEALS OR DISENGAGING THE ROTARY O-RING OF O-RING SEALS. ONLY MINOR ADJUSTMENTS TO THE END CLEARANCE OF LESS THAN 0.005" CAN BE MADE WHILE THE SEAL IS INSTALLED.

1. Loosen the two set screws in the outer face of the bearing housing and turn the thrust bearing assembly clockwise until it can no longer be turned by hand. Back off counter-clockwise until the rotor shaft can be turned by hand with a slight noticeable drag. This is zero end clearance.
2. For standard end clearance, back off the thrust bearing assembly the required length measured on the outside diameter of the bearing housing. **See Table 3.**
3. Tighten the two setscrews in the outboard face of the bearing housing with equal force against the bracket. Your pump is now set with standard end clearances and locked.

   NOTE: Be sure the shaft can rotate freely. If not, back off additional length on outside diameter and check again. Best practice is to verify pump end clearance with a feeler gauge or a dial indicator.
4. Operating the pump at higher temperatures or viscosities may require additional end clearance. Contact your local Viking representative for specific clearance recommendations. The additional length on the outside diameter of the bearing housing for an extra 0.001" of end clearance is shown in **Table 3.**

Pump Size	Model	Standard End Clearance (Inch)	Turn Brg. Housing C.C.W. Length On O.D. (Inch)	Additional Length On O.D. Brg. Housing For .001" End Cl. (Inch)
H, HL	157B 4157B 257B 4257B	0.005	1	13/64
KS K,KK LQ,LL	157B 4157B 257B 4257B	0.008	1-3/8	11/64
LS	157B 4157B 257B 4257B	0.010	1-7/8	3/16

TABLE 3

INSTALLATION OF BUSHINGS

When installing carbon graphite and silicon carbide bushings, extreme care must be taken to prevent breaking. Carbon graphite and silicon carbide are brittle materials and easily cracked. If cracked, the bushing will quickly disintegrate. Using a lubricant and adding a chamfer on the bushing and the mating part will help in installation. The additional precautions listed below must be followed for proper installation. **Note: Bushings cannot be replaced in Acetal or PEEK idlers.**

1. A press must be used for installation.
2. Be certain bushing is started straight.
3. Do not stop pressing operation until bushing is in proper position. Starting and stopping will result in a cracked bushing.
4. Check bushing for cracks after installation.
5. Silicon carbide bushings require a shrink fit. Heat the 770 stainless idler to 450°F (232°C) before installing a cool silicon carbide bushing.

VIKING PUMP

IDEX FLUID & METERING

WARRANTY

Viking warrants all products manufactured by it to be free from defects in workmanship or material for a period of one (1) year from date of startup, provided that in no event shall this warranty extend more than eighteen (18) months from the date of shipment from Viking. The warranty period for Universal Seal series pumps ONLY is three (3) years from date of startup, provided that in no event shall this warranty extend more than forty-two (42) months from the date of shipment from Viking.

UNDER NO CIRCUMSTANCES SHALL VIKING BE LIABLE UNDER THIS WARRANTY OR OTHERWISE FOR SPECIAL, INCIDENTAL, INDIRECT, CONSEQUENTIAL OR PUNITIVE DAMAGES OF ANY KIND, INCLUDING, BUT NOT LIMITED TO, LOST OR UNREALIZED SALES, REVENUES, PROFITS, INCOME, COST SAVINGS OR BUSINESS, LOST OR UNREALIZED CONTRACTS, LOSS OF GOODWILL, DAMAGE TO REPUTATION, LOSS OF PROPERTY, LOSS OF INFORMATION OR DATA, LOSS OF PRODUCTION, DOWNTIME, OR INCREASED COSTS, IN CONNECTION WITH ANY PRODUCT, EVEN IF VIKING HAS BEEN ADVISED OR PLACED ON NOTICE OF THE POSSIBILITY OF SUCH DAMAGES AND NOTWITHSTANDING THE FAILURE OF ANY ESSENTIAL PURPOSE OF ANY PRODUCT.

THIS WARRANTY IS AND SHALL BE VIKING'S SOLE AND EXCLUSIVE WARRANTY AND SHALL BE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ALL WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT ALL OF WHICH OTHER WARRANTIES ARE EXPRESSLY EXCLUDED.

See complete warranty at www.vikingpump.com.

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